

### Acknowledgments

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## Research Note

# Scanning Electron Microscopy Study of a Copulating Monorchiid (Trematoda: Digenea)

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**ABSTRACT:** During a survey of parasites of fishes from the Kuwaiti coast of the Arabian Gulf, a pair of digeneans were found in copulation in the intestine of 1 of 4 *Gnathodon speciosus*; the digeneans were recovered and studied by scanning electron microscopy (SEM). SEM micrographs suggest a 1-way transfer of sperm and reveal the presence of longitudinal ridges with openings or depressions in the metratermal segment of the terminal organ of the recipient. The digeneans were identified as monorchiid species of *Lasiotocus*. This is the first evidence of copulation in a digenean demonstrated by SEM.

**KEY WORDS:** *Lasiotocus* sp., Monorchidae, scanning electron microscopy, copulation, metraterm, *Gnathodon speciosus*, marine fish.

Trematodes, with few exceptions, are hermaphroditic flatworms that are capable of both cross- and self-fertilization. Most investigators believe that cross-fertilization is the rule. In cross-fertilization, sperms are transferred by the process of copulation from 1 individual to another in 1 direction or by reciprocal exchange.

The act of copulation has rarely been observed directly. Among the earlier studies are those of Fuhrmann (1930) on *Prosotocus confusus* (Looss, 1894) and Rausch (1947) on *Microphallus opacus* (Ward, 1894). Palombi (1932) reported copulation via Laurer's canal in *Diphtherostomum brusinae* (Stossich, 1889) and *Haploporus benedeni* (Stossich, 1887) and through the uterus in *Podocotyle fractum* (Rudolphi, 1819). (For more recent reviews dealing with copulation and fertilization, see Fried and Harris, 1971; Nollen 1983, 1997.) It is very probable, however, that most acts of copulation occur through the genital atrium by insertion of the cirrus or ejaculatory duct into the metraterm or the uterus. Here, we present an observation,

which we consider direct evidence, of copulation through the metraterm in a monorchiid.

During the course of a survey of helminth parasites of Kuwaiti marine fishes conducted between October 1992 and December 1994, 4 golden trevally, *Gnathodon speciosus* (Forsskal, 1775) (Carangidae), were found to harbor monorchids; in 1 of these hosts, a pair of digeneans in copula and 8 unpaired specimens were found. The digeneans were washed in saline, fixed in alcohol-formaldehyde-acetic acid, and stored in 70% ethanol. The copulating pair was dried for scanning electron microscopic (SEM) examination using the critical point technique, coated with gold-palladium, observed, and photographed using a JEOL, JSM-6300 SEM. The other specimens, which seem to represent 2 species, were stained in alum carmine, dehydrated through an ascending series of ethanol, cleared in clove oil, and mounted in Canada balsam.

Scanning electron micrographs show the copulating pair in a parallel but reverse position, the anterior end of 1 facing the posterior end of the other (Fig. 1A, B). Both the large cirrus sac and the metraterm part of the terminal organs are extruded (Figs. 1, 2), with the cirrus sac hooking up with the metraterm in an apparent 1-way transfer. The 1-way transfer is in contrast with the 2-way transfer described by Fuhrmann (1930) in *Prosotocus confusus*. The micrographs (Figs. 1, 2) show a conspicuous preacetabular genital pore that is wide open. The impression is that the recipient (Fig. 1B) is responding to the approach of the cirrus of the partner (the insertor) by opening its genital pore and protruding the metraterm. In the fixed specimens, the genital pore is barely visible, and no evidence of any metratermal protrusion is seen. The micrographs (Figs. 3, 4) also reveal that the metraterm has longitudinal ridges with pores or depressions. The function of these ridges is not

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